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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/846,536	05/02/2001	Wen-Ting Chu	TS1999-646B	4121

28112 7590 01/07/2004

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EXAMINER	
NADAV, ORI	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 01/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/846,536	Applicant(s) CHU ET AL.	
	Examiner ori nadav	Art Unit 2811	AW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 October 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 20 is rejected under 35 U.S.C. 102(b) as being anticipated by Harada et al. (5,341,026).

Harada et al. teach in figure 1 and related text a metal structure 100 on a semiconductor substrate 1, a via hole in an insulator layer 5 exposing a portion of an underlying lower level metal interconnect structure, a recessed metal plug structure 206 located in a bottom portion of the via hole, with the recessed metal plug structure 206 overlying and contacting the portion of the lower level metal interconnect structure 4, exposed in the via hole; and the metal structure 100 comprised with a metal segment 101, 102, 103 located only on a first portion of a smooth top surface of the insulator layer (the metal segment 101, 102, 103 is the metal which is located in the area on the right side of the via hole) with an absence of the metal segment on a bare second portion of the insulator layer (the area located on the left side of the via hole), and with the metal structure comprised with a metal ring structure 102, 103 (the metal which is located over the via hole) attached to the metal segment and located on exposed sides of top portion of the via hole, and wherein the metal ring structure comprised of metal spacers located on all the sides of a top portion of the via hole, traversing all exposed sides of a top portion of the via hole from the top perimeter of the via hole to a top surface of the

recessed metal plug structure, and with the metal spacers terminating and converging at center of top surface of the recessed plug structure.

Although Harada et al. do not explicitly state that layer 206 is a recessed plug, layer 206 can very well be characterized as a recessed plug, because layer 206 is formed in a bottom portion of the via hole, overlying, contacting and connecting the lower interconnect level 4 to the upper interconnect level Therefore, Harada et al. teach a recessed plug, as claimed.

Regarding the claimed limitations of the metal spacers terminating and converging at center of top surface of the recessed plug structure, Harada et al. teach metal spacers terminating and converging at center of top surface of the recessed plug structure, because when the metal spacers terminate and converge at the center of top surface of the recessed plug structure they merge and thus can be indistinguishable from each other. Layer 102, for example, can be characterized as a two metal spacers which terminated and converged at the center of top surface of the recessed plug structure.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harada et al. (5,341,026).

Regarding claim 21, Harada et al. teach a lower level metal interconnect structure with an underlying and overlying titanium tungsten layer. Harada et al. do not teach a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness between about 100 to 1500 Angstroms. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness between about 100 to 1500 Angstroms in Harada et al.'s device in order to protect the lower level metal interconnect structure with conventional barrier layer, of which official notice is taken, and because it is well within the skills of an artisan to use a lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, and underlying and overlying layers of a thickness between about 100 to 1500 Angstroms, respectively, in order to provide adequate conductivity to the device. Note that substitution of materials is not patentable even when the substitution is new and useful. Safetran Systems Corp. v. Federal Sign & Signal Corp. (DC NIII, 1981) 215 USPQ 979. Note further that the law is replete with cases in which

when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Regarding claims 22-23, Harada et al. teach a recessed metal plug structure comprised of tungsten. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms in Harada et al.'s device, because it is well within the skills of an artisan to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms, in order to reduce the size of the device and in order to provide adequate conductivity to the device, respectively. Note that the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Regarding claim 24, Harada et al. teach a metal ring structure 103 comprising aluminum spacers.

Response to Arguments

3. Applicant argues that Harada et al. teach a metal segment attached to all portions of the metal structure

Harada et al. do not teach a metal segment attached to all portions of the metal structure. Harada et al. teach a metal segment 101, 102, 103 located only on a first portion of a smooth top surface of the insulator layer (the metal segment 101, 102, 103 is the metal which is located in the area on the right side of the via hole) with an absence of the metal segment on a bare second portion of the insulator layer (the area located on the left side of the via hole),

4. Applicant argues that Harada et al. do not teach metal spacers terminating and converging at center of top surface of the recessed plug structure.

Harada et al. teach metal spacers terminating and converging at center of top surface of the recessed plug structure, because when the metal spacers terminate and converge at the center of top surface of the recessed plug structure they merge and thus can be indistinguishable from each other. Layer 102, for example, can be characterized as a two metal spacers which terminated and converged at the center of top surface of the recessed plug structure.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722

and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(703) 308-8138**. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**

O.N.
January 6, 2004

ORI NADAV
PATENT EXAMINER
TECHNOLOGY CENTER 2800